

0002AH	Handling and Storage Instructions, Seq. No. A008	1	Lot	\$_____	
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002AJ	End Item Final Inspection Record, Seq. No. A009	1	Lot	\$_____	

COMMERCIAL ITEM DESCRIPTION

The below Engineering Specification M153 describes the design, fabrication and delivery of the following material for a Gas Turbine Test Facility including equipment design drawings, to be furnished 20 weeks or sooner after date of contract.

Two (2) gas turbine exhaust duct/stack systems, elements per system are: lined duct sections, lined rectangular to square transition section, lined square to round transition section and lined round stack sections. Material is from A-36 carbon steel and 409 stainless steel. Material thickness range from 12 gauge to 0.25 inch. Insulation is from ceramic fiber. Exhaust temperature 1200 F (max).

ENGINEERING SPECIFICATION M153 EXHAUST DUCTING SYSTEM

1.0 INTRODUCTION

1.1 This specification establishes the requirements for the design, manufacture, and delivery of two (2) exhaust ducting systems, for a Gas Turbine Test Facility at the Naval Surface Warfare Center, Carderock Division (NSWCCD), Philadelphia, PA. All equipment are to be delivered twenty (20) weeks or sooner after date of contract.

1.2 Each of the system's components, specified herein, shall be fabricated, assembled, and shipped in as much a complete unit as possible.

1.3 All components described in this specification must be designed to be structurally and thermally adequate to withstand lifting and loading conditions identified and exhaust operating requirements as described in this specification.

2.0 SCOPE

2.1 Equipment and Services to be provided by the Contractor.

2.1.1 The Contractor shall be responsible for providing all exhaust ducting system components as specified herein including all bolting hardware and gasketing to make-up the flange joints (with 10% spares).

2.1.2 The Contractor shall be responsible for the design, procurement of materials, fabrication, assembly, cleaning, surface preparation, painting, packaging and shipping (complete and ready for erection) of all items included in this specification. The Contractor shall assume the responsibility of his product in transit.

2.1.3 The design, materials, and fabrication of structural steel shall be in accordance with the specification of the American Institute of Steel Construction, latest edition, except where modified by local government regulations or customer's special requirements. Modifications for local government regulations or customer's special requirements shall be made only if they exceed the requirements of the Codes.

2.1.4 All ducting component sections shall have hardened lift points to allow lifting and movement. These lift points shall be designed where possible to lift through the system component center of gravity. Temporary shoring shall be designed, manufactured, and provided with the exhaust components to facilitate movement. Where the integral strength of a component section will not allow free standing storage, storage stands shall be designed, manufactured and provided. All design drawings and hardware shall have centers of gravity calculated and clearly marked. Where the component sections have been made symmetrical, lift points shall be made on both sides of the mirroring section feature.

2.1.5 The Contractor shall be responsible for the accuracy of its designs and full conformance to the requirements presented in this specification. Approval of any drawings, calculations and/or tests by the Government shall not relieve the Contractor from these responsibilities.

2.1.6 Nothing in this specification shall relieve the Contractor of the responsibilities for performing, in addition to the requirements of this specification, such analyses, tests, inspections, and other activities which the Contractor considers necessary to insure that the design, material and workmanship are satisfactory for the service intended, or as may be required by common usage and/or good practice.

2.1.7 Inspections shall be performed as hereinafter specified.

2.1.8 The Contractor shall maintain all hereafter-specified data and records. These will be delivered to the Government after the work has been accepted.

2.1.9 The Contractor shall establish and maintain a system for the control of quality during manufacture and examination, which will insure that all components and assemblies furnished under this specification meet requirements hereinafter specified.

2.1.10 The Contractor shall mark all parts and units of assembly as hereinafter specified.

2.1.11 The Contractor shall, prior to shipment, assemble all exhaust ducting system components as specified herein to ensure adherence to the tolerances indicated by this specification. The Government or the Government's agent shall witness the assembly by the Contractor. A minimum of seven (7) days is required to arrange such a visit.

2.1.12 The Contractor shall provide the Government and his agent access at all times to all places where work is being done under this specification. They shall have full facilities for unrestricted inspection of such work.

2.1.13 The Contractor shall provide all necessary and incidental labor, materials, tools, equipment and services which must be employed to satisfy the requirements stated in this specification.

2.1.14 The Contractor shall provide, for review and approval, all of the data requirements described herein this specification including, complete and detail drawings for all equipment and work under this specification.

2.2 Equipment and Services to be provided by the Government.

2.2.1 The Government will unload at the site, store, and erect all items furnished by this specification.

2.2.2 The Government will provide a flexible joint between the ducting and the gas turbine at time of erection of all items furnished by this specification. The flexible joint is identified under GE source control drawing L22133.

3.0 Technical Proposal

3.1 General

A technical proposal, which includes (at a minimum) the information listed below, shall be provided with the Contractor's quotation. A proposal, which does not present sufficient information for the Government to confirm the capability of the Contractor, may be rejected or otherwise determined to be technically unacceptable.

3.1.1 The Contractor shall submit four (4) copies of a technical proposal.

3.1.2 The Contractor shall submit a copy of their Quality Assurance System Program Plan which meets the requirements of ANSI/ISO/ASQC Q9001-1994 or equivalent certification.

3.1.3 The Contractor shall detail their experience in design, fabrication, and manufacture of rectangular and transitional ducting of double wall construction.

3.1.4 The Contractor shall explain their product line through descriptive literature and other information in order for the Government to evaluate that the Contractor has the facilities, capabilities, and resources necessary to fabricate, manufacture, and deliver equipment required by this specification.

3.1.5 The Contractor shall provide recent specific examples of same or similar product(s), as required by this specification, in order for the Government to evaluate that the Contractor has, or can, fully comply with specifications, quality assurance, inspection, and delivery requirements of this specification.

3.2 Drawings

3.2.1 Outline drawings of the exhaust ducting system components as described herein and Figure-1, Attachment I showing all of the accessories and giving all dimensions.

3.2.2 Provide cross-sections to show typical details of all elements of the exhaust ducting system components.

3.3 Estimated Production Schedule

3.3.1 The schedule shall show the total number of days estimated from date of contract to major milestones. Milestones should include but not necessarily be limited to:

3.3.1.1 Engineering submittals.

3.3.1.2 Receipt of materials.

3.3.1.3 Fabrication complete.

3.3.1.4 Complete preparation for shipping.

3.3.1.5 Delivery.

Note: The Contractor may assume, for purposes of estimating, that review and approval of engineering submittals will require two (2) weeks.

4.0 Applicable Documents

4.1 The following specifications, standards, and codes form a part of this specification. The revision in effect on the date of the RFP shall apply unless later revisions are agreed to by both parties. The design, material, and assembly of the items

identified in this specification shall be in strict compliance with all applicable sections herein.

4.2 Referenced Specifications, Standards, and Codes:

- 4.2.1** “American National Standards Institute” (ANSI).
- 4.2.2** “American Society for Testing and Materials” (ASTM).
- 4.2.3** “American Institute of Steel Construction, Inc.” (AISC).
- 4.2.4** “American Iron and Steel Institute” (AISI).
- 4.2.5** “Occupational Safety and Health” (OSHA), Part-1910.
- 4.2.6** “National Fire Protection Association” (NFPA-70).
- 4.2.7** “American Welding Society” (AWS D1.1, D9.1, 10.12).
- 4.2.8** “Steel Structures Painting Council” (SSPC).
- 4.2.9** “D.O.T. Regulation-49”.
- 4.2.10** “Building Officials and Code Administration” (BOCA).

5.0 System Requirements

5.1 General

5.1.1 Each set of exhaust ducting system components will be installed between an existing section of exhaust ducting and an LM2500 gas turbine, prime mover for the Gas Turbine Test Facility.

5.1.2 Site Conditions

5.1.2.1 Location: Indoor/Outdoor.

5.1.2.2 Ambient Temperature Range: 5°F to 105°F.

5.1.2.3 Relative Humidity Range: 0% to 100%.

5.1.2.4 Altitude: Approximately 30ft. above sea level.

5.1.2.5 Loading:

Wind, exposed surfaces, Table 1611.7(3), Exposure C, 75 mph Basic Wind Speed (Reference 4.2.10)

Seismic, Section 1612.0 (Reference 4.2.10)

Dynamic Flow Loads, per Section 5.1.4

5.1.3 Design Load Conditions

5.1.3.1 Erection: Dead load plus wind or seismic load.

5.1.3.2 Normal Operating: Dead load, plus dynamic load (per Section 5.1.4), plus wind or seismic load.

5.1.3.3 Allowable unit stresses shall be stipulated per Section 4.2.3, except where modified by local requirements.

5.1.4 Operating Conditions

5.1.4.1 Maximum exhaust gas flow is 193 lbs/sec at 892°F, referred to 100°F ambient temperature.

5.1.4.2 Maximum gas temperature is 1200°F.

5.1.4.3 The exhaust ducting systems' components shall be designed to withstand pressure pulses resulting from engine surge.

5.2 Arrangement

5.2.1 The exhaust ducting systems' components shall be designed in accordance with the arrangement depicted in Figure-1. The ducting systems must conform to the outline dimensions provided in the figure; however, the Contractor may provide an alternate design details if approved in government review.

5.2.2 Construction shall be such that no gaps or leaks occur in the assembly.

5.2.3 The exhaust ducting systems shall be designed to be self-supporting at four support weldments per exhaust ducting system provided at the roof level. The exhaust ducting systems shall be locally reinforced as required to allow lateral bracing as shown in Figure 1.

5.2.4 The exhaust ducting systems shall be designed to interface with stainless steel flanges at the inlet to and outlet from each system.

5.3 Design Criteria

5.3.1 The structural design of each exhaust duct component shall consider and account for forcing frequencies of 60Hz, 4320Hz, 5400Hz, and 6720Hz.

5.3.2 The exhaust ducting system components shall be of double wall construction and designed such that the inner and outer walls are vertically and laterally independent of each other to allow freedom of thermal expansion to prevent buckling, distortion, and/or failure.

5.3.2 Each rectangle-to-square transition piece shall have a removable latched personnel access.

5.3.3 The external walls of the exhaust ducting components shall be welded 3/16 inch thick ASTM A-36 Carbon Steel and sufficiently rigid to be supported by 3/8 inch thick (min) end flanges and withstand operating conditions so indicated.

5.3.4 All surfaces exposed to the hot exhaust gas shall be ASTM A-176, type 409 Stainless Steel.

5.3.5 Flanged joints shall be designed to minimize the exposure of the gaskets to hot exhaust gas.

5.3.6 Insulation between the inner and outer walls shall be 8 lbs/cu.ft. density of "Durablanket-HP-S, Ceramic Fiber" rated at 2300°F.

5.3.7 All structural welding shall be in accordance with AISC specifications in conjunction with the Structural welding Code-Steel, AWS D1.1.

5.3.8 Lift points (eyes) shall be provided to permit loading, unloading, and erection. Contractor shall certify that Lifting points have been inspected and tested; are safe for operation, provide record of such inspection and testing, and rated load. These points shall be marked with Serial number, Date of Test, Safe Working Load in Pounds, Testing Activity, and Description of Test.

5.4 Tolerances

5.4.1 Tolerances shall be in accordance with the following:

5.4.1.1 Flatness of flanges shall be held within a tolerance of $\pm 1/8$ inch. Contractor shall insure that flanges are not distorted due to the torque of bolts.

5.4.1.2 Flanges shall maintain parallelism or perpendicularity, as applicable, within a total tolerance of $\pm 1/8$ inch.

5.4.1.3 Flanges shall maintain diagonal squareness of $\pm 1/8$ inch.

5.4.1.4 All linear dimensions shall be $\pm 1/8$ inch.

5.4.1.5 Location of all holes shall be held to a true position tolerance of $\pm 1/16$ inch diameter circle.

5.5 Materials and Processes

5.5.1 Materials exposed to the hot gas flow shall be ASTM A-176, Type 409 Stainless Steel, 12 gauge thick (min.).

5.5.2 Welding of the liner should be avoided through the use of bending. The Contractor shall provide details regarding liner fabrication with submittal of design.

5.5.3 Material for structural shapes shall be ASTM A-36 Carbon Steel. External duct plate shall be 3/16 inch thick (min.). Flanges shall be 3/8 inch thick (min.).

5.5.4 Exhaust ducting gasket material shall be 2 1/2 inches wide by 1/4 inch thick Tetraglass 1200°F drop-warp tape in finished form ready for installation.

5.5.5 Bolting material shall be ASTM A-325, Grade-5, zinc-plated with ASTM A-563, Group DH, circular washers and hex nuts.

5.5.6 Insulation shall be free of asbestos and be 8 lbs/cu.ft. density Durablanket-HP-S Ceramic Fiber 2300°F. Thickness of insulation shall be in excess of 4 inches thick to prevent voids from occurring at installation.

5.5.7 Surface Preparation and Painting

5.5.7.1 Sandblast to a commercial finish per SSPC-SP6.

5.5.7.2 Paint all Carbon Steel interior and exterior surfaces with Carboline Zinc HS-11, Green, 3.0 to 5.0 mils dry film thickness.

6.0 Design and Acceptance

6.1 Design Review

6.1.1 The Contractor shall furnish descriptions and drawings of the proposed exhaust ducting system(s) components to the Government for review. No work is authorized until formal authorization to fabricate is received. Review and comment of drawings is not to be construed as relieving the Contractor of the responsibility for the fabrication of the exhaust system(s) components and/or voiding of the Contractor's guarantees. Review and approval of preliminary design package will be 14 days after receipt of the package by the Government.

6.2 Design Change Provision

6.2.1 No substitutes or alterations are authorized without written approval in the form of a change notice to the order.

7.0 Contractor Data Requirements

7.1 Required three (3) weeks after Date of Contract

7.1.1 Preliminary drawings of the exhaust ducting systems' components giving sufficient details to allow evaluation of the exhaust systems with regard to flange bolting arrangements, double wall construction, structural integrity, installation and conformance with major requirements of this specification.

7.1.2 Estimated loads at support points and centers of gravity of the exhaust ducting system(s) components.

7.1.3 Proposed Quality Assurance plan in accordance with the requirements of ANSI/ISO/ASQC Q-9001-1994.

7.2 Required six (6) weeks after Date of Contract

7.2.1 Final and firm location of the following:

7.2.1.1 Bolting patterns of all flange sections.

7.2.1.2 Final information on exhaust ducting system(s) components geometry, weights, and loads.

7.2.2 Preliminary issue of source control drawings for review and comment by the Government. The drawings shall include the following:

7.2.2.1 Bill of materials including part number, size, material designation, and quantity.

7.2.2.2 Contractor's name and part number for all subcontracted items.

7.2.3 Final calculations for the structural and thermal adequacy of the exhaust system(s) components shall be provided prior to fabrication.

7.2.4 The following procedures for work performed by the Contractor or his contractor:

7.2.4.1 Manufacturing and processing procedures

7.2.4.2 Inspection checklist or program

7.2.4.3 Cleaning procedures

7.2.4.4 Painting procedures

7.2.4.5 Shipping procedures

7.2.4.6 Repair welding procedures

7.2.4.7 Quality assurance checklist

7.2.5 A report with the following information:

7.2.5.1 The exhaust ducting system component(s) 1st natural frequencies.

7.2.5.2 Loading response analysis.

7.2.5.3 Loads at support points sufficient for the Government to confirm the adequacy of the existing support structure.

7.2.5.4 Weights, centers of gravity, and lift points for each component.

7.3 Required ten (10) weeks after Date of Contract

7.3.1 Three (3) reproducible sets of the final source control drawing showing all the required details of this specification, additional details resulting from the Government's reviews, and any "As Built" details resulting during manufacture.

7.3.2 Complete and detailed erection instructions for the exhaust ducting system(s) components. Lifting and erection instructions are to be part of the source control drawing. Three (3) sets of the erection instructions are to be shipped with the equipment.

7.3.3 Instructions for handling and storage of all equipment.

7.4 Drawing Format Requirements

7.4.1 Drawings supplied to be Contractor's "D" size format.

7.4.2 The drawing format must be clear. Numbers, Letters, and lines must be clear and dark, maintaining uniform density and properly spaced to insure clarity when reduced in size.

7.4.3 The drawing(s) title block must include title, drawing number, revision number, and date.

8.0 Preparation for Shipment

8.1 Protection

8.1.1 The Contractor shall provide shipping protection appropriate for the method of shipment and final destination. Preparation is subject to review and comment by the Government.

8.2 Packing

8.2.1 The Contractor shall pack, label and ship all equipment and materials in compliance with D.O.T. Regulation 49.

8.3 Coding, Marking, Labeling, and Placarding

8.3.1 The Contractor shall provide a permanently attached nameplate with each exhaust ducting system. The nameplates shall display Contractor's address and purchase order number.

8.3.2 Each separate deliverable item shall be tagged or stenciled with the drawing number, part name, Contractor's part number or identification number, weight, center of gravity and lift points.

8.3.3 Any angles, bars, channels, etc., used for shipping and requiring removal before installation shall be painted yellow and clearly identified by stenciling in a contrasting color.

8.3.4 Instructions for proper storage at the job site (i.e. lift points, cable angles, etc.) shall be provided.

9.0 Shipping Instructions

9.1 The Contractor shall contact the Government two (2) weeks prior to being ready for shipment.

9.2 Shipping address: Naval Surface Warfare Center
Carderock Division/Philadelphia Detachment
Receiving Code 3361, Bldg. 542
Philadelphia, PA 19112-5067
Attn: Mr. William Singiser, Code 9111
Phone: (215) 897-1894